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What forces the Redistribution of Snow over Smooth Landfast Sea Ice?

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An understanding of the temporal evolution of snow over sea ice at different spatial scales is critical for the improvement of snow distribution parameterization in sea ice models and for the study of physical-biological coupling. Snow depth on sea ice is primarily controlled by the interaction between surface condition (i.e. type and roughness of sea ice) and the meteorological conditions of the area. Statistical analyses of the evolution of snow distribution over smooth first-year sea ice suggest that several changes in snow distribution correspond to changes in depositional and drifting events. Changes in the probability density functions (PDFs) indicate that deeper and larger snow drifts formed after snowfall or drifting events. At the microscale, snow events caused the infilling of the valleys between snowdrifts, creating larger areas of uniform snow depth. The ability to reproduce the snow distribution over sea ice was tested using SnowModel. Results from two independent model runs suggest that the model was not able to adequately reproduce the range in the observed snow distribution. The lack of agreement may in part be due to the spatial domain of the model compared to the location of the sampling sites, as well as the use of meteorological data from land stations. Results comparing meteorological variables from land- and ice stations suggest that air temperature on land can be used as a proxy measure for that on ice, while simple associations for other meteorological variables do not exist. This is a significant limitation to the study of the evolution of snow distribution since on ice measurements are not routinely collected in the Arctic.